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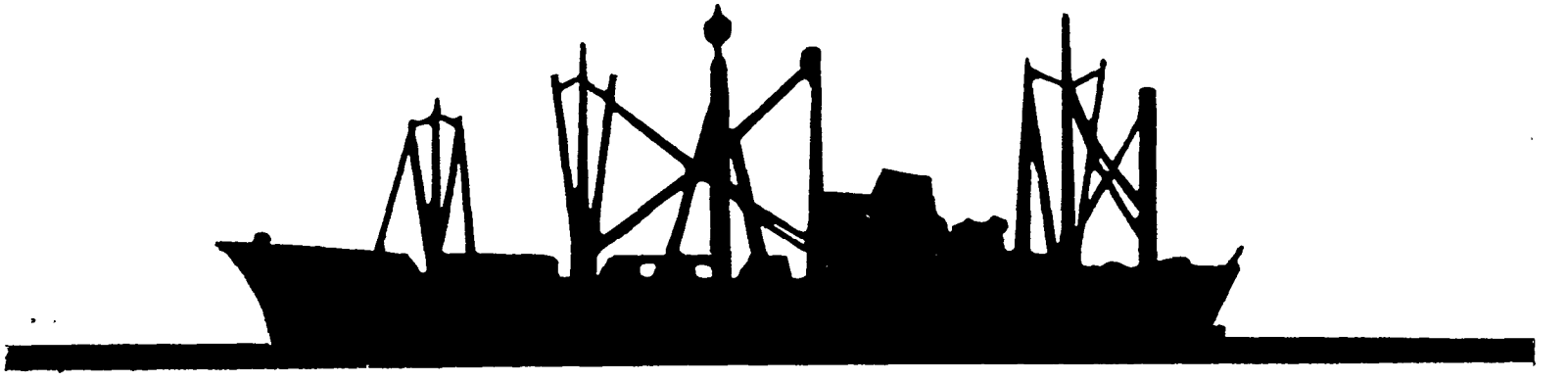

INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

THE CONCEPTION AND CONSTRUCTION OF A HIGH PRODUCTIVITY BARGE BUILDING SHIPYARD

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Mr. Rack has more than 20 years of shipbuilding management and consulting experience. At Todd Shipyards Corporation, Galveston Division, he was one of a four-man team responsible for design of a new $100 million shipyard to build ULCC including all new facilities, organization and operation. At General Dynamics Corporation, Quincy Shipbuilding Division, he directed all aspects of the operations departments in support of the LNG and VLCC programs. Prior to this he was responsible for the 180-acre facility, all maintenance, production engineering, ship services and research laboratories. He also participated as member of SNAME Panel SP-2 Production Methods.

Mr. Rack holds a BS degree from the United States Merchant Marine Academy.

ABSTRACT

Shipbuilding Consultants, Inc. (SCI) of Dickinson, Texas acting as consultant to Bergeron Industries, Inc. (BII) of St. Bernard, Louisiana and with the assistance of the Carlson Corporation (CC) as architect/engineers, conceived, designed and constructed a new high productivity shipyard on a 88 acre site near Demopolis, Alabama for rapid multiple construction of barges up to 300 foot length size range. One barge is to be delivered every other day. Five major modules per barge are fabricated and assembled by an indoor semi-automated production line feeding sequential outdoor erection positions. Barges are launched via a winch controlled launch system from the elevated site which is 80 feet above the Tombigbee River. This paper describes the facility layout and production features. Further the actual construction from ground breaking (9/28/81) to first barge christening, and facility dedication (4/21/82) to first barge launch (6/29/82) in nine months is discussed.

In early June 1981 Bergeron Industries, Inc. (BII) retained Shipbuiling Consultants, Inc. (SCI) to develop a production plan for the efficient construction of "super jumbo" open hopper barges measuring 260 feet long, 52.5 feet wide and 12 feet high with a 4 feet high coaming. One barge is comprised of 580 tons, and has double the capacity of the conventional inland waterways hopper barges.

The production plan included the design and construction schedule for a new facility since BII's existing plants in Lousiana and Mississippi had contract backlogs which precluded meeting additional demands.

In July 1981 BII incorporated a new subsidiary, Bergeron Barges, Inc. (BBI). BII's foresight and determination resulted in the award of a $60 million contract to BBI believed to be the largest single inland hopper barge contract ever awarded to one company. The contract was awarded to BBI by Central Gulf Lines, Inc. to construct and deliver 116 super jumbo barges by early 1983.

This contract led to the development of BBI's Demopolis Alabama plant, an 88 acre site located on the Tombigbee River. In building the $10 million modern facility over three quarters of a million cubic yards of dirt were moved, one and a half miles of railroad track were laid and a 100,000 square feet building was constructed to cover the highly automated fabrication and assembly equipment and work areas.

SC1 acting as BBI's "Turnkey Manager" contracted to the Carlson Corporation (CC) for preliminary civil engineering and construction estimates. The final site was selected after surveys and soil evaluation were completed. CC was retained for engineering and construction management.

Figure 1 indicates the actual schedule that was attained leading to a successful barge launch nine months after groundbreaking. One of the more interestings items of the many involved during construction was the establishing of an earth dam which permitted the completition of all four launchways prior to the dam removal in May 1982.

The slides and photographs indicate the construction progress.

Figure 2 is the layout of the shipyard and also indicates the outside work stations.

Production Plan

The production plan was designed for maximum efficiency at each operation. Adequate capacity was planned to provide for the required throughput of two and one half barges per week. This rate has yet to be attained for various reasons which will be discussed as each work station is reviewed.

Figure 3 lists each work station along with a brief description of the work performed at that station.

Figure 4 is a layout of the fabrication and assembly building and also indicates all work station locations. The slides and photos indicate more of the details of each work station.

The heart of the production plan is a collection of equipment conceived by SC1 and built and installed by Ogden Engineering Corporation (OEC) which results in the fabrication of stiffened panels utilizing efficient methods. These stiffened panels represent the majority of the fitting and welding in the barge. These stiffened panels are then combined into erection modules which in turn are welded by semi-automatic equipment prior to erection.

Figure 5 is a layout of the panel line and Figure 6 is a summary of the feet of welding and the number of stiffeners fabricated for one barge on this panel line.

The following additional items contribute to the productivity of the operation:

- All material entering the fabrication and assembly building exit as a completed module. Only five modules are required to build a complete barge.

- 0 Jigs and fixtures are utilized for most subassemblies and assemblies.

- 0 Only two modules are erected by the crane. Two modules are erected by hydraulic lifting arms and one is "transferred" into its erection position.

- 0 Efficient module and barge transfer system.

- 0 Nine building positions are available if required.

- 0 Sufficient height under the barge in the blast and paint area (station 32) for men to work under barge.

In addition to BBI's Demopolis facility, SC1 has been deeply involved in actual modernization of facilities at General Dynamics, Quincy and Electric Boat, Bay Shipbuilding, Port Allen Marine, Nashville Bridge, St. Louis Ship (Caruthersville), and Bergeron Shipyard *over* the last twelve years. The most important lesson learned from these experiences is that the degree of success is completely dependent on "people".

Good white and blue collar workers are required to attain the cost savings and to meet the schedules estimated at conception.

The second important lesson learned is that a good Management Information System (MIS) is required. The heart of the MIS is a good Planning and Production Control (PPC) system. Most knowledgable shipbuilders do not require MIS or PPC if they get the plans and material on time, however Management needs the systems in order to "MANAGE".

FACILITY SCHEDULE

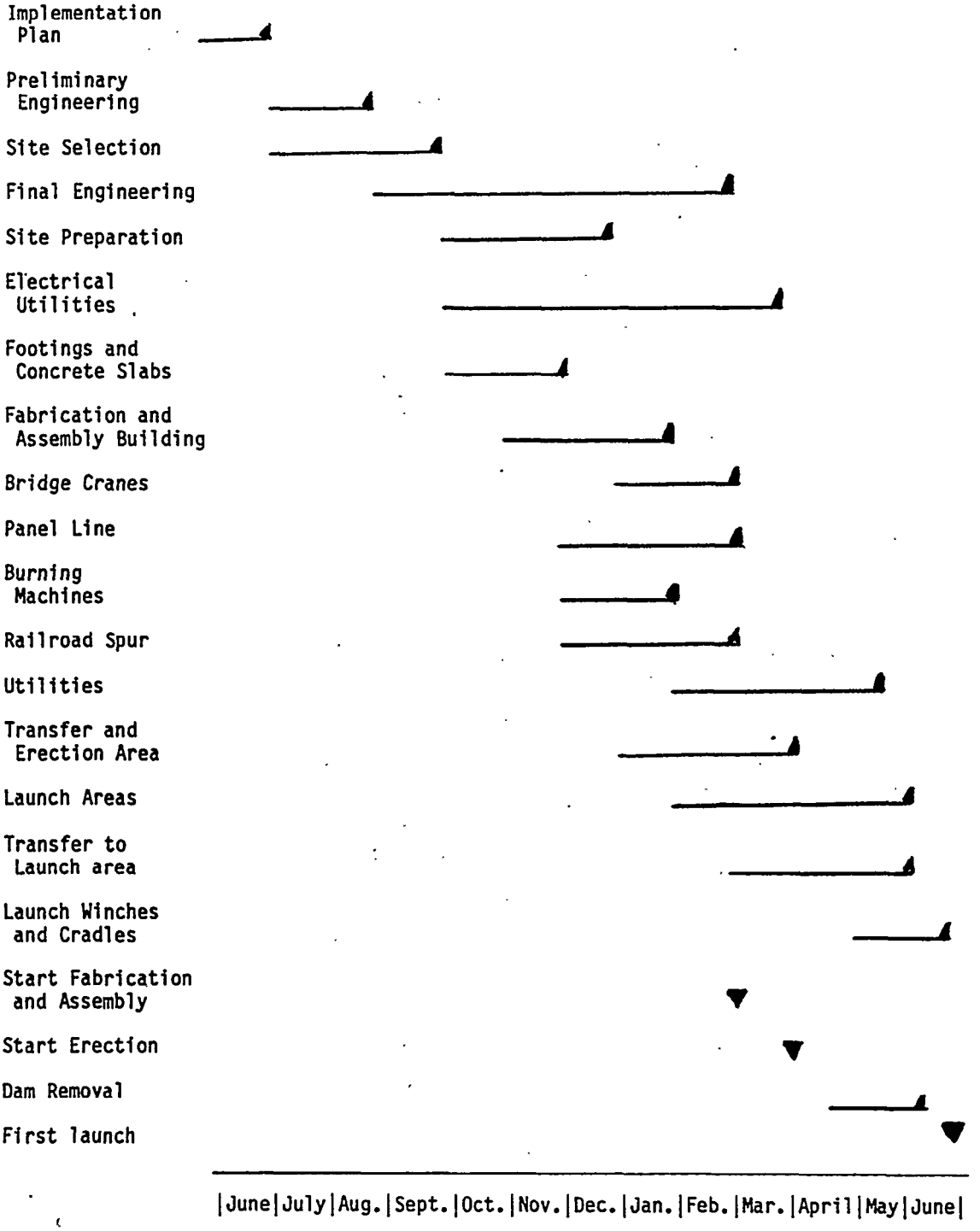

Figure 1

SHIPYARD LAYOUT

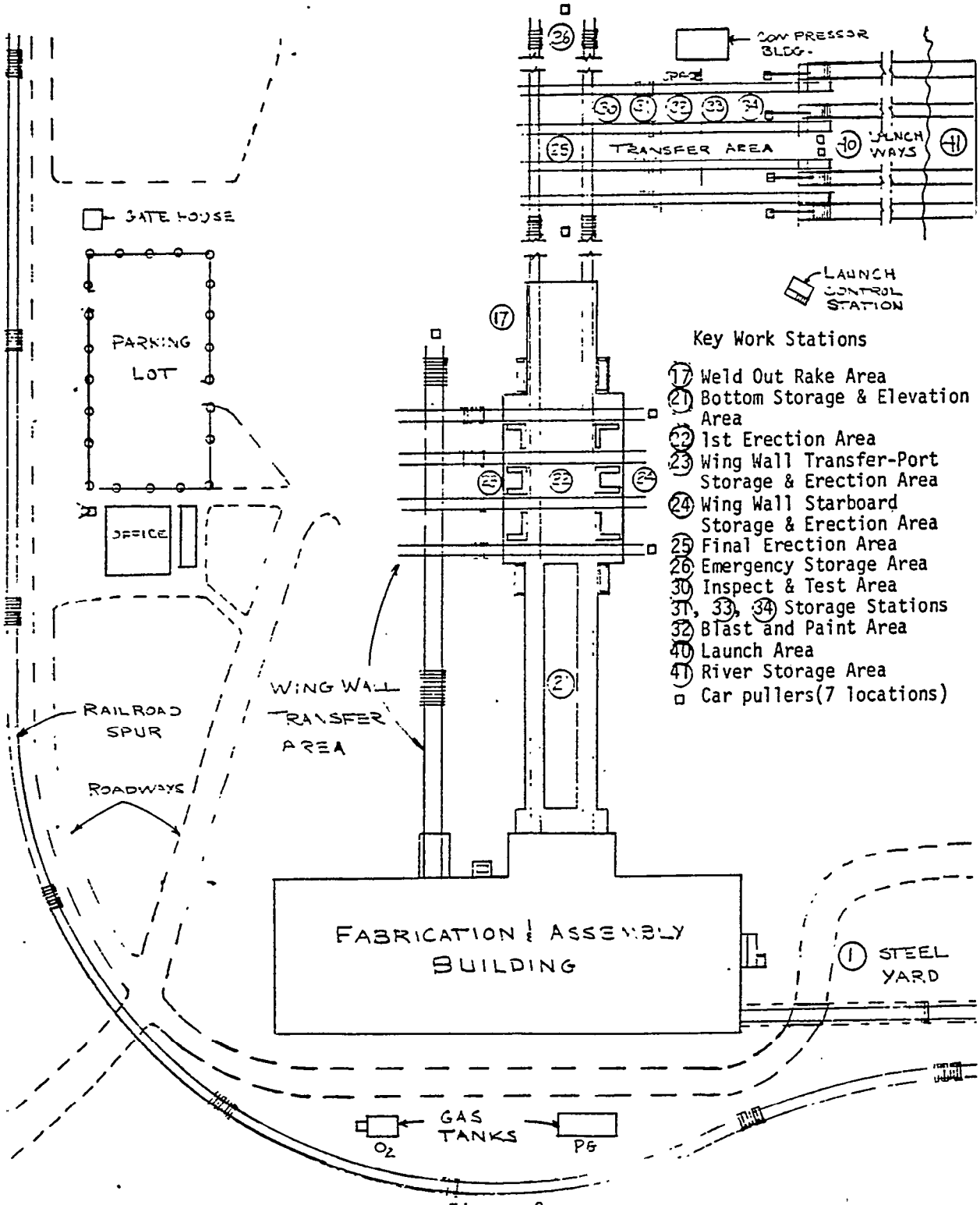

Figure 2

Work Stations

No.	Title	Description
1.	Steel Yard	Storage area for raw steel plate, shapes, and barge material.
2.	Flame Plane	Burns raw plate into square rectangular plates.
	DNC Burn	Burns contour parts and also squares plates.
3.	Shear	Mechanically shears plate.
	Press Brake	Bends plate and,shapes using dies and templates.
4.	Bergeron Bender	Bends plate to radius of forming cylinder.
7.	Inlet Buttweld	One sided butt welds up through 5/8" using magnet bed for alignment.
8.	Panel Stiffener	Automatically fits and welds up to nine stiffeners per panel.
9.	Exit Butt Weld	One sided butt welds stiffened bottom panels to each other using magnet bed for alignment.
10.	Tank Top Fitting Area	Fits Tank top plates and plug weld to bottom panel floors.
11.	Seam Welder	Seam welds tank top plates to bottom floors and to each other.
12.	Iron Worker/Angle Roll	Iron worker cuts various shapes. Angle Roll rolls Angles.
	Wing Wall Unit Assembly Area	Assembly of sub assemblies into wing wall units.
14.	Wing Wall Module Assembly Area	Assembly of Wing Wall Units into complete module.
15.	Stern Assembly Area	Assembly of complete stern section utilizing various jigs.
16.	Rake Assembly Area	Assembly of campleted rake section. Assembly jigs used to make rake sub-assemblies.
17.	Weld Out Stern/Rake Area	Complete internal welding and attachments to Rake and stern.
21.	Bottom Storage and Elevation Area	Completed bottom storage area, barge is lifted up and buggies transfer to station number 22.
22.	Wing Wall and Rake Erection Area	Wing walls and rake are erected to bottom.
23.	Wing Wall Transfer, Port Storage and erection Area.	Transfer of wing walls out of shop. Port Wing Wall storage and erection.
24.	Wing Wall Starboard Storage and erection Area.	Starboard wing wall storage and erection.
25.	Stern Erection and Structural Completion	Stern erection and final structural work.
	Emergency Barge Storage Area	Storage Area for emergencies.
26.	Final Inspection and Test Area	Pick up, inspection, and test.
	Barge Storage Area	Barge Storage if necessary.
32.	Barge Blast and Paint Area	Exterior Blast and Paint Area.
	Barge Storage Area	Blast and Paint block areas-Barge Storage.
34.	Barge Storage Area	Barge Storage if necessary.
40.	Launch Area	Controlled launch of barges using winches and cradles also Haul out of Barges.
41.	River Storage	River Storage and fleeting of Barges.

Figure 3

FABRICATION & ASSEMBLY BUILDING

Key Work Stations

1 Steel Yard
2 Flame Plane
3 DNC Burn
4 Shear
5 Press Brake
6 Bergeron Bender
7 Inlet Buttweld
8 Panel Stiffener
9 Exit Butt Weld
10 Tank Top Fitting Area
11 Seam Welder
12 Iron Worker/Angle Roll
13 Wing Wall Unit Assembly Area
14 Wing Wall Module Assembly Area
15 Stern Assembly Area
16 Rake Assembly Area
* Future Installation

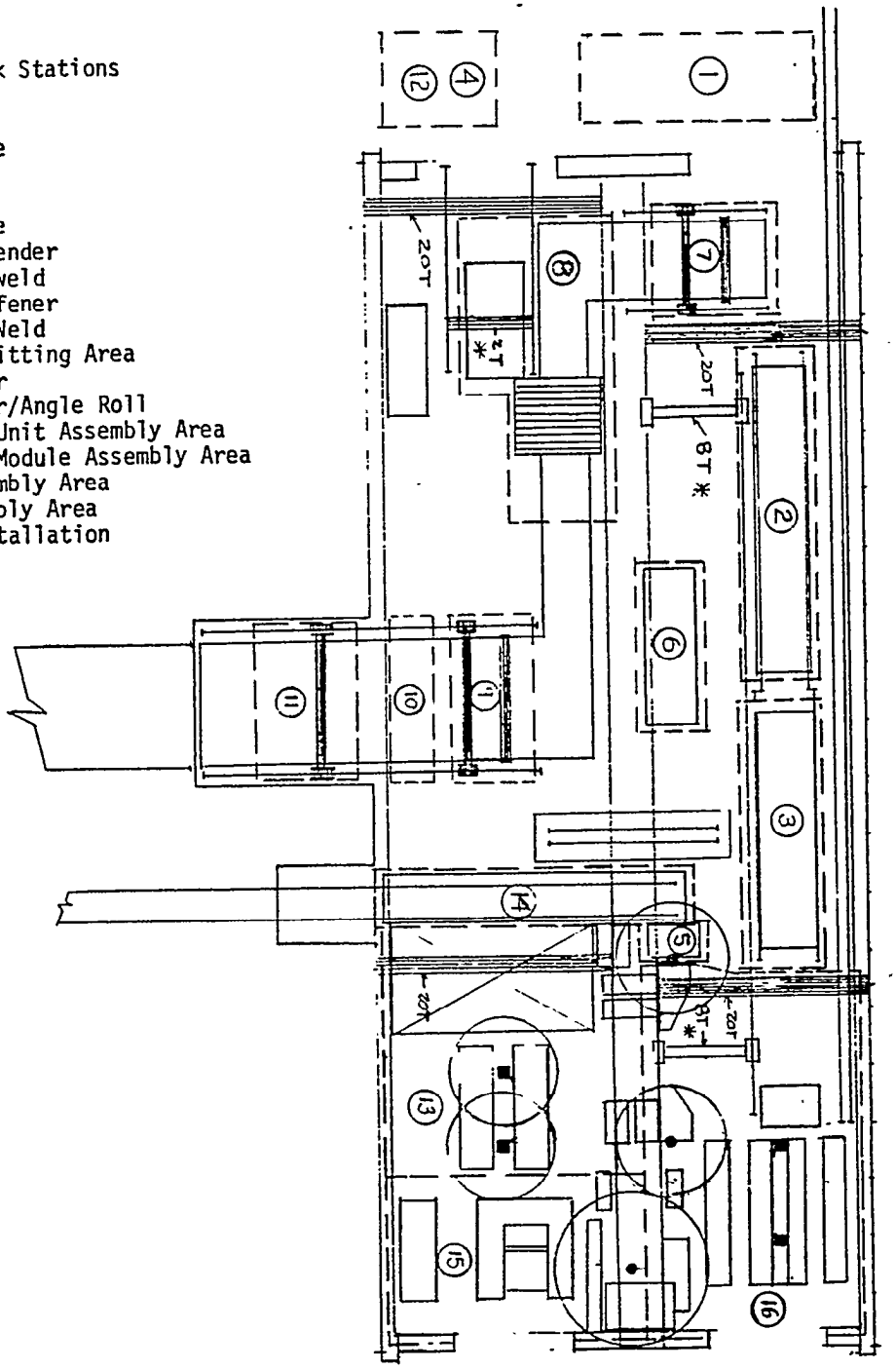

Figure 4

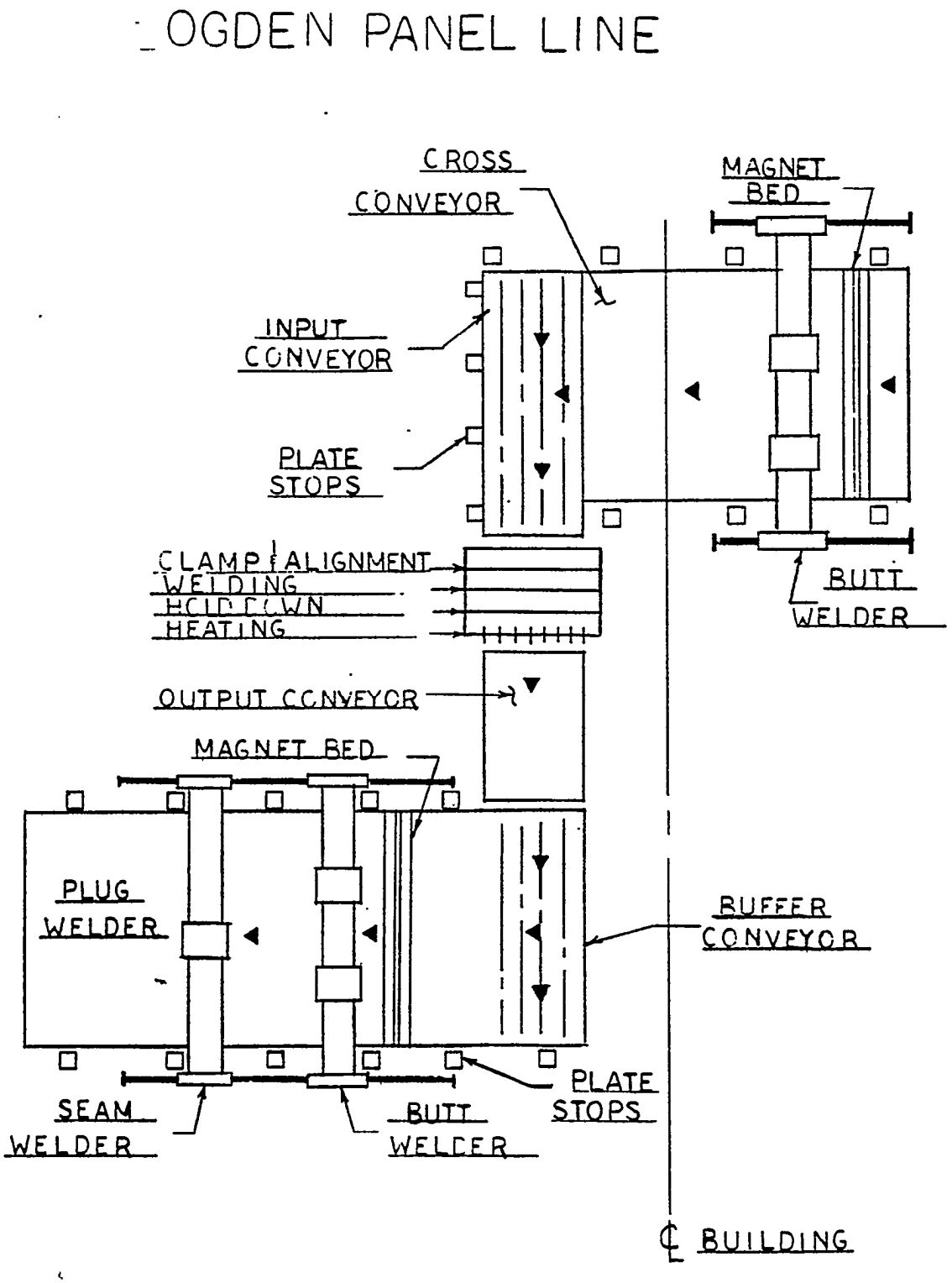
OGDEN PANEL LINE
CROSS
CONVEYOR
MAGNET
BED
INPUT
CONVEYOR
PLATE
STOPS
CLAMP
WELDING
HOLD DOWN
HEATING
ALIGNMENT
BUTT
WELDER
OUTPUT CONVEYOR
MAGNET BED
PLUG
WELDER
BUFFER
CONVEYOR
PLATE
STOPS
SEAM
WELDER
BUTT
WELDER
℄ BUILDING

Figure 5

PANEL LINE PER BARGE SUMMARY

	Inlet Butt Weld		Panel Stiffener			Exit Butt Weld	
	No. of Welds	Total Ft. of Welds	No. of Cycles	Total No. of Stiffeners	Total ft. of Weld	No. of Welds	Total ft. of Welds
Bottom 50'	24	1200	12	107	10700	11	550
Side 50'	-	-	9	54	5400	-	-
Hopper 50'	9	450	9	36	3600	-	-
Side Deck 50'	tack	-	3	9	900	-	-
Rake Bottom 31'	6	186	-	-	-	-	-
Rake Deck 27'	2	54	3	18	972	5	135
Rake Bulkhead 50'	1	50	-	-	-	-	-
Transom Plate 50'	tack	-	1/3	3	300	-	-
Stern Bulkhead 50'	-	-	-	-	-	1	50
TOTALS	42	1940'	36 1/3	227	21,872'	17	735'

Figure 6